IN THE SPECIFICATION

Please add the following paragraphs at page 16 line 1:

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an exemplary monolith according to the present invention;

Figure 2 is a graph showing the comparison of the pressure drop through a monolith according to the present invention compared to that of a filter element of a conventional gas mask;

Figure 3 is a graph showing the adsorption breakthrough performance of an activated monolith according to the present invention;

Figure 4 is a graph showing the breakthrough characteristics of a 7 cm length of a monolith according to the present invention prior to activation when challenged with 8000 mg/m^3 of butane at 2L/minute;

Figure 5 is a graph showing the relationship between "plateau concentration" and flow rate for carbonised monolith sections exposed to butane;

Figure 6 is a graph showing the comparison of the leakage rate (the initial plateau in figure 4) in the inactivated monolith as single pieces and when the 4 cm and 6 cm monolith were present as 2 cm segments close packed or slightly separated by a distance of 1 cm;

Figure 7 is a graph showing the toluene weight loss from a monolith according to the present invention during regeneration;

Figure 8 is a graph showing the toluene weight loss from a monolith according to the present invention during regeneration after a second adsorption cycle;

Figure 9 is an apparatus used to absorb toluene on the monoliths according to the present invention;

Figure 10 is a graph showing the pressure drop through the resin monoliths according to the present invention as a function of monolith length and comparing a short segment of the carbonised monoliths;

Figure 11 shows a conventional military gas mask with a large canister attached to the side;

Figure 12 shows a new design of mask based on the low pressure drop small diameter monoliths according to the present invention; and

Figure 13 shows a "flat pack" of monoliths according to the present invention.

Please amend page 8, lines 16 to 25 as follows:

The nature of the regeneration process is such that whilst the equilibrium adsorption capacity of the carbons can exceed 50% weight the working capacity, defined as the uptake after many adsorption desorption cycles and once the bed has reached a stable operating performance, is frequently less than 5%, and it is this that fixes the volume of adsorbate required. A great deal of effort has been expended on both optimising the design of the adsorber system to provide the best possible gas flows etc (e.g., ~~US5776227~~ U.S. Patent No. 5,776,227) for regeneration and on the optimisation of the adsorbent to provide improved regeneration characteristics (e.g., ~~US5324703~~ U.S. Patent No. 5,324,703). The bed volumes are however still large and these can present both a significant pressure drop constraint and problems with attrition of the carbon granules and bed settling.

Please amend page 16, lines 17 to 18 as follows:

Referring to ~~figure~~ Figure 1. The monolith can be characterised by the wall thickness "t" and the channel size "W".

Please amend page 18, lines 8 to 22 as follows:

The milled powder can then be extruded to produce polymeric monolithic structures with a wide range of cell structures, limited only by the ability to produce the required extrusion die and suitable dies are available commercially. Production of the monoliths is greatly facilitated by the extrusion of the cured resin powder rather than of a more abrasive ceramic or carbon powder. At this stage the monolith has a bimodal structure – the visible cell structure with open cells of around 300 to 2000 microns cell dimension and cell walls with thickness' between around 300 and 2000 microns – and the macropore structure within the walls generated by the voids between the sintered resin particles. An advantage of the current invention is that significantly smaller cell sizes can be produced than in existing monolithic structures as it is a polymer that is being extruded, rather than a ceramic material, which ~~reducers~~ reduces abrasion of the die and the pressures required during extrusion. Cell densities of 44 cells per square cm (290 cells per square inch) have been achieved in the resin monoliths and it is believed that maximum cell densities in excess of 250cpc are possible (>1600cpi).

Please amend the page 18 line 30 to page 19 line 8, as follows:

The carbonization steps take place preferably by heating above 600°C for the requisite time e.g., 1 to 48 hours and takes place under an inert atmosphere or vacuum to prevent oxidation of the carbon. A further major advantage of the monoliths of the current invention is

that the controlled porosity of the resin structure allows very high heating rates to be used without causing any distortion or cracking of the finished carbon structure despite the substantial weight and volume loss during pyrolysis. Heating rates in excess of 200C per hour have been used with large ~~monolithe~~ monolithic structures without problems and the routine firing cycle is 100C/hour to the carbonisation (800C) or oxidation (~950C) temperatures.

Please amend page 21 lines 10 to 13 as follows:

The invention also provides apparatus for the removal of contaminants from air which apparatus comprises a monolithic porous carbon filter element and an inlet and ~~a~~ an outlet for the filter element whereby air can be drawn via the inlet through the filter element and out through the outlet.

Please amend page 22 lines 17 to 30 as follows:

In applications for low pressure drop vapour removal devices for use in ~~for~~ the removal of low levels of contaminants from air, in for instance electronic device fabrication plants, operating theatres etc. and for the elimination of gasoline vapour release from vehicles the filter elements can be placed in a suitably shaped container and the monoliths formed to fit into the container. For example the monoliths can be used as circular segments with diameters up to around 10 cm diameter that will be loaded into preformed plastic housings. These will either be simple formed sheets that could be used in for instance ceiling filters for fabrication plants or personal protection devices, or more complex mouldings that will provide for feed and regeneration gas flows for use in for instance vehicle vapour recovery devices. The use of such devices will considerably reduce production costs as there will be no requirement to handle large

volumes of granular, dusty material which can give rise to problems with machinery and potential health hazards. The production route will also ensure that filter bypassing can no longer occur.

Please amend page 27 line 4 as follows:

NR = pellets ~~to~~ too weak to allow measurement

Please amend page 27 line 16 to page 28 line 3 as follows:

Stainless steel trays 30cm square and 5cm deep were filled with a powder comprising a standard commercial Novolak, supplied by Borden Chemicals with a code number of J1011S. The trays were then placed on a trolley inside a curing oven ~~which~~ and the cure was carried out by raising the temperature to 100C over a period of 1.5 hours, holding at 100°C for 1 hour, raising the temperature to 150°C over a further 1 hour and holding at 150°C for 1 hour. The cured block was then hammer milled to give a coarse powder of greater than 90 microns particle size. The hammer milled powder was then jet milled using a Hozakawa 100AFG jet mill to give a mean particle size of 50 microns.

Please amend page 28 lines 5 to 15 as follows:

2kg of the jet milled powder was then formed into a dough in a Z-blade mixer using approximately 900gg of water and Methocell (120g), polyethylene oxide (30g), Polyethylene glycol (75g), glycerol (20g) and LDM Acrylate (60) as extrusion aids. The dough was then extruded using a high pressure ram extruder at a pressure of around 40bar using a conventional monolith die to produce a 42 mm diameter monolith with a cell structure with wall

thickness, "t" in ~~figure~~ Figure 1 of 1.2 mm and a channel size, "W" in ~~figure~~ Figure 1, of 1.4 mm giving a total open area of 29.4% with a green cell density of 15 cells per square cm (cpe) or 95 cells per square inch (cpi). The extruded monolith was air dried for at least 12 hours by rotating slowly in ambient air to ensure it remained straight although more rapid drying can be achieved using for instance air less drying.

Please amend page 28 lines 17 to 28 as follows:

The monolith could then be either carbonized as a single long length or in segments whose length was consistent with the end use with the appropriate allowance made for linear shrinkage. For long lengths (20cm) the monolith was carbonized in a six zone furnace using carbon dioxide as the purge gas. A typical carbonization cycle used a ramp rate of 100°C/hour with 1 hour at temperature before cooling back to room temperature. On carbonization the monolith loses 50% weight and approximately 50% volume. This shrinkage results in a substantial increase in cell density and, in cases where a high cell density and a thin cell wall is required, this is a major advantage of the production process. After carbonization the monolith had a structure with a wall thickness ('t' in ~~figure~~ Figure 1) of 0.85mm and a channel width ('W' in ~~figure~~ Figure 1) of 0.98mm giving a total open area of 29.4% with 55 cells per square cm (195cells per square inch).

Please amend page 29 lines 16 to 22 as follows:

A comparison of the pressure drop through the monolith compared to that of the filter element of a conventional gas mask is shown in ~~fig.~~ Figure 2. The granular pressure drop was determined at a flow rate equivalent to 30L/min through a standard 10cm diameter, 2cm

deep granular bed. The black point shows a conventional gas mask operating under normal gas flow conditions compared to that of the monolith under identical conditions as against the lowest line that shows the pressure drop for the monolith performance.

Please amend page 29 lines 24 to 26 as follows:

The adsorption breakthrough performance of the activated monolith is shown in ~~Fig.~~ Figure 3. The 32mm diameter activated carbon monolith segment was challenged with a gas flow of 2L/min containing 8000mg/m^3 of hexane in dry air.

Please amend page 30 lines 6 to 10 as follows:

For comparison ~~figure~~ Figure 4 shows the breakthrough characteristics of a 7cm length of the monolith prior to activation when challenged with 8000 mg m^{-3} of butane at 2L/minute. This demonstrates the critical impact of the micropore diffusion on the monolith performance with an almost immediate low level breakthrough followed by the normal breakthrough at ~100 minutes.

Please amend page 30 lines 18 to 24 as follows:

~~Fig~~ Figure 6 shows a comparison of the leakage rate (the initial plateau in ~~figure~~ Figure 4) in the inactivated monolith as single pieces and when the 4cm and 6cm monolith were present as 2cm segments close packed or slightly separated by a distance of 1cm. This demonstrates a significant improvement in performance that can be obtained by using multiple, shorter, sections of the monoliths and even more surprisingly that if the segments are separated by a small gap the performance is dramatically further improved.

Please amend page 31 lines 7 to 9 as follows:

The adsorption of gasoline in air inlet ducts was simulated using toluene as the worst case contaminant for regeneration. The apparatus used is shown in ~~figure 8~~ Figure 9. This consists of a bottle (1) acting as a toluene reservoir, containing toluene (3).

Please amend page 31 lines 11 to page 32 line 13, as follows:

Approximately 2cm lengths of monolith (6) made by the method of example 1 were mounted on top of a ground glass joint (4), (5) using shrink wrap. This was then placed in the top of toluene reservoir (1). Air was flowed through the vessel through inlet (2) over the surface of the toluene and then through the monolith (6) to the atmosphere at (7). With the vessel at 30C and an air flow of ~600ml/minute the toluene vapour concentration determined from the rate of loss of toluene from the reservoir was ~0.37% volume. The performance was monitored by weighing the entire system and the stopper containing the monolith at time intervals. During the initial adsorption phase, when toluene vapour in the air was adsorbed in the monolith there was no weight loss for the entire system but the monolith steadily gained in weight showing the transfer of the toluene from the reservoir to the monolith. Once the monolith was saturated the entire system lost weight steadily whilst there was no further gain in the monolith weight. This can be seen in ~~figure~~ Figure 7 the region between these two zones, where there was a reduced weight gain in the monolith and the onset of some weight loss from the overall system, corresponds to the breakthrough region in a conventional breakthrough plot. The data provides the monolith capacity at initial breakthrough and the saturation capacity. It can be seen that the breakthrough on the first cycle occurs between 350 and 300 minutes whilst the subsequent breakthroughs occur at around 50 minutes reflecting the loss of capacity due to the

incomplete removal of the adsorbed gasoline. Nonetheless the capacity in the later cycles of ~20% is sufficient for the inlet manifold application.

Please amend page 32, lines 15 to 24, as follows:

The monolith was regenerated between adsorption cycles. The toluene reservoir was replaced with an empty reservoir and air was drawn through the monolith ~~at (9)~~ using a diaphragm pump ~~and out at (8)~~. This was continued until 1800L of air had been passed through the monolith – a value fixed by the regeneration requirements in induction manifold filters, assuming a full filter diameter of 10cm. During this period the weight loss of the system, equivalent to the toluene weight loss from the monolith, was determined. The results are shown in ~~figure~~ Figure 7. It can be seen that the rate of weight loss steadily decreases reflecting the higher heat of adsorption at lower coverages. After 1800L of air had been passed the experiment was stopped. The weight loss at this stage reflects the first cycle working capacity of the monolith.

Please amend page 32, lines 26 to page 33 line 2 as follows:

The adsorption cycle was then repeated with the results shown in ~~figure~~ Figure 8. The second weight uptake was approximately equal to the weight loss in the first regeneration cycle. These adsorption and regeneration cycles were then repeated several times. The results demonstrated that there was little change in the system toluene working capacity after the first cycle with a toluene working capacity of 7. This is well in excess of the target working capacity for air inlet filters.

Please amend page 33, lines 26 to page 33 line 2 as follows:

The standard dough formulation, as described in example 4, was used to extrude monoliths with an outside diameter of approximately 10mm and a green cell density of 44cpc and a carbonised cell density of 9lcpc. After carbonisation the monoliths has an OD of 7.3mm. The pressure drop through the resin monoliths as a function of monolith length and a short segment of the carbonised monoliths was determined and is shown in ~~figure~~ Figure 10. The results have been normalized to the pressure drop through 1cm cross section and 1cm length to allow a direct comparison. It can be seen that the resistance to flow increases as the length decreases reflecting the higher pressure drop at the entrance to the monoliths due to turbulence.

Please amend page 33, lines 16 to 27, as follows:

The low pressure drop of the monolith structures and their enhanced adsorption potential can be made use of in a novel gas mask configuration. Figure 11 shows a conventional military gas mask with the large canister (l0) attached to the side. These canisters present a significant physiological load to the wearer due to their pressure drop and are also inconvenient. A new design of mask based on the low pressure drop small diameter monoliths of example 8 is shown in ~~figure 13~~ Figure 12. This comprises a "flat pack" of monoliths (11) attached to either side of the face mask. This design will allow a lower pressure drop, reducing the physiological impact of the mask, combined with greater convenience and capacity. A possible structure for the "flat pack" is shown in ~~figure 11~~ Figure 13 in which a series of monoliths (21) are packed flat in container (14). Air is breathed through inlet ~~(2)~~ (22), passes through manifold ~~(5)~~ (15) into monoliths (21) and through outlets ~~(3)~~ (33) into the mask.